

REMARKS

The Office Action mailed on November 20, 2002 has been received and its contents have been carefully reviewed. Claim 3, 6 and 10-12 have been cancelled without prejudice or disclaimer. Claims 1, 4, 7-9, 13 and 15-17 have been amended. No new matter has been added. Claims 1, 2, 4, 5, 7-9 and 13-17 are pending in this application.

Title

The Office Action asserted that the title was not descriptive. Applicants have amended the title to be descriptive.

Drawings

The Office Action indicated that Fig. 18 should be designated by a legend such as --Prior Art--. Applicants propose to label Fig. 18 as "PRIOR ART" as indicated in red in the Proposed Changes to the Drawings, submitted herewith. Accordingly, applicants request that the objection to the drawings be withdrawn.

Specification

The disclosure was objected to for informalities. Applicants have amended the specification as suggested in the Office Action, and, accordingly, request that the objection be withdrawn.

Rejection under 35 U.S.C. § 112, second paragraph

Claim 12 was rejected under 35 U.S.C. § 112, second paragraph. This rejection is moot in light of the cancellation of claim 12.

Rejections under 35 U.S.C. §§ 102 and 103

Claims 1-3, 9, 10 and 13 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 3,805,061 to De Missimy et al. (hereafter "De Missimy"). Claims 6, 7, 11 and 17 stand rejected under 35 U.S.C. 103(a) as being unpatentable over De Missimy. Claims 4, 5 and 8 stand rejected under 35 U.S.C. 103(a) as being unpatentable over De Missimy in view of U.S. Patent No. 5,302,942 to Blau (hereafter "Blau"). Claims 12 and 14-16 stand rejected under 35 U.S.C. 103(a) as being unpatentable over De Missimy in view of U.S. Patent No. 6,175,106 to Buitkamp et al. (hereafter "Buitkamp"). Applicants respectfully traverse these rejections, insofar as they pertain to the claims as amended, for the reasons given below.

As background, independent claim 1 is directed to a light curtain generating device. The device includes a light emitting unit array and light receiving unit array each comprising a group of single-beam optical modules, wherein each single-beam optical module comprises a single light emitting unit or a single light receiving unit comprising a lens, an optical element and a holder integrally incorporated with the lens and optical element, and wherein the holder is separated from holders of other single-beam optical modules. One advantage of the structure recited in claim 1, is that a light curtain generating device can be selectively fabricated so as to be adjustable with respect to the length of the light emitting and receiving pillar assemblies, and the number and pitch of the light beams (see specification, paragraph 12). The structure recited in claim 1 is an improvement over prior art structures which do not employ single beam modules, and thus do not have the same flexibility to select the number of light beams (see specification, page 2). Applicants submit that neither De Missimy, or the remaining references cited in the rejections, suggest the light curtain generating device as recited in claim 1.

De Missimy is directed to an object detecting apparatus. De Missimy discloses three transmitter assemblies 6A, 6B, 6C, each comprising a number of light sources 8, and

three receiver assemblies 16A, 16B, 16C, each comprising a number of photodetectors 18 (Fig. 1, col. 3, lines 42-47; col. 3, line 63-col. 4, line 1). De Missimy, in contrast to the device recited in claim 1, discloses that each of the assemblies 6A, 6B, 6C or 16A, 16B, 16C is formed as an integrated unit incorporating multiple light sources 8, or photodetectors 18, respectively. In this regard, De Missimy is similar to the prior art devices discussed in the present specification (page 2) which employ multiple beam modules. Moreover, De Missimy discloses lens holder panels (12A, 12B, 12C, 22A, 22B, 22C) which each hold multiple lens, where each lens corresponds to one light source or photodetector. Thus, De Missimy does not disclose the separated holders as recited in claim 1. In sum, De Missimy does not disclose a device as recited in claim 1, which includes a light emitting unit array and light receiving unit array each comprising a group of single-beam optical modules, wherein each single-beam optical module comprises a single light emitting unit or a single light receiving unit comprising a lens, an optical element and a holder integrally incorporated with the lens and optical element, and wherein the holder is separated from holders of other single-beam optical modules.

Moreover, the De Missimy device lacking the single-beam optical modules with their separated holders of claim 1, fails to suggest the attendant advantages of a light curtain generating device which can be selectively fabricated so as to be adjustable with respect to the length of the light emitting and receiving pillar assemblies, and the number and pitch of the light beams. The possibility of selective fabrication provides advantages such as energy saving. Moreover, the position of a module may be focused at a particular point, or to accommodate unusual structural designs and smaller sized openings or access points.

Neither Blau or Buitkamp cure the deficiencies of De Missimy. Blau was cited for alleged teaching of plastic supports, and Buitkamp for allegedly teaching mounting positions. Both Blau and Buitkamp, however, fail to disclose a device as recited in claim 1, which includes a light emitting unit array and light receiving unit array each comprising a group of single-beam optical modules, wherein each single-beam optical module comprises

a single light emitting unit or a single light receiving unit comprising a lens, an optical element and a holder integrally incorporated with the lens and optical element, and wherein the holder is separated from holders of other single-beam optical modules.

The remaining claims ultimately depend from claim 1 and are patentable for at least the same reasons, discussed above, as well as for patentable features recited in those claims. For example, claim 9 recites a “signal processing means for electrically and selectively disabling the optical element mountable positions.” The portion of De Missimy cited for allegedly disclosing this feature of claim 9, however, merely discloses strobing the energy of the light source in a predetermined order. This is quite different from “electrically and selectively disabling the optical element mountable positions” as recited in claim 9. As another example, claim 7 recites “each single-beam optical module is attached to the metallic plate at a side of the single-beam optical module extending in parallel with the optical axial line.” Since De Missimy does not disclose single-beam optical modules with respective separated holders, De Missimy can not suggest or disclose “each single-beam optical module is attached to the metallic plate at a side of the single-beam optical module extending in parallel with the optical axial line.” Moreover, De Missimy does not recognize the problems caused by unusual structures or protecting or preventing particular access points.

For the reasons given above, applicants submit that the claims are patentable over the art cited in the rejections under 35 U.S.C. 102 and 103. Accordingly, applicants respectfully request that the rejection of the claims under 35 U.S.C. 102 and 103 be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, applicants respectfully submit that all of the pending claims are now in condition for allowance. An early notice to

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this effect is earnestly solicited. If there are any questions regarding the application, the Examiner is invited to contact the undersigned at the number below.

Respectfully submitted,

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Versions with Markings to Show Changes Made

In the Specification:

[0005] (6) Because various kinds of optical modules are needed for different light beam pitches, stocking them creates a problem, and the cost for the metallic die assemblies is therefore high. For instance, if the light beam pitches include 15 mm and 20 mm, a separate metallic die assembly is needed for each of them. If the light beam pitches include 15 mm and 30 mm, and a 30 mm pitch is achieved by using the 30 mm pitch optical module by enabling only every second light beam, there are unused optical components (such as lenses) between each pair of adjacent light beams that are used, and the cost for the unused optical components will be wasted.

[0006] A second object of the present invention is to provide a light curtain generating device which can readily adapt itself to each particular application at low cost.

[0007] A third object of the present invention is to provide a light curtain generating device which can readily adapt itself to the desired length of the detection area in a highly precise manner.

[0008] When connecting a plurality of circuit boards, to ensure the accuracy in the pitch, it is necessary to join the adjacent circuit boards without any break between them. According to the illustrated embodiment, it is accomplished by properly arranging flat cables and associated connectors. As shown in the enlarged view of Figure 10, a connector [84] 84a is attached to an extreme edge portion of the master light beam circuit board 84, and a connector 87a is mounted on a corresponding slave light beam circuit board 84 at a position somewhat set back from the edge opposing the master light beam circuit board 84. These two connectors 84a and 87a are joined to each other by a flat cable 88. An adequate amount of slack is provided in the flat cable 88 to facilitate the replacement of the circuit boards.

In the Claims:

1. (Once Amended) A light curtain generating device, comprising a light emitting pillar assembly accommodating an array of light emitting units within a pillar case and a light receiving pillar assembly accommodating an array of light receiving units within a pillar case, the light emitting pillar assembly and light receiving pillar assembly being placed opposite to each other so as to form a light curtain for detecting an object between the pillar assemblies, characterized in that:

the light emitting unit array and light receiving unit array accommodated in the respective pillar cases each comprise a group of single-beam optical modules,

each single-beam optical module comprising a single light emitting unit or a single light receiving unit comprising a lens, an optical element and a holder integrally incorporated with the lens and optical element so as to align the lens and optical element with a prescribed optical axial line, and the holder being separated from holders of other single-beam optical modules,

each pillar case accommodating a base frame defining mounting positions for a plurality of single-beam optical modules, and

each single-beam optical module being mounted in the mounting position of the base frame.

4. (Once Amended) A light curtain generating device according to claim [3] 1, wherein the holder is made of plastic material.

7. (Once Amended) A light curtain generating device according to claim [6] 1, wherein the base frame comprises a metallic plate member, and each single-beam optical module [forming the optical module block] is attached to the metallic plate at a side of the single-beam optical module extending in parallel with the optical axial line.

8. (Once Amended) A light curtain generating device according to claim 7, wherein each single-beam optical module [forming the optical module block] is attached to the metallic plate by a snap fit arrangement.
9. (Once Amended) A light curtain generating device according to claim [3] 1, further comprising a circuit board having a plurality of optical element mountable positions, and signal processing means for electrically and selectively disabling the optical element mountable positions.
13. (Once Amended) A light curtain generating device according to claim 1, wherein each pillar [assembly comprises] case accommodates at least two base frames arranged in series along a length of the pillar assembly [each defining mounting positions for single-beam optical modules, and a plurality of single-beam optical modules mounted in the mounting positions of the base frames].
15. (Once Amended) A light curtain generating device according to claim [14] 13, wherein the two base frames have different numbers of mounting positions.
16. (Once Amended) A light curtain generating device according to claim [14] 13, wherein the two base frames have different lengths.
17. (Once Amended) A light curtain generating device according to claim [14] 13, wherein the base frames [consist of] comprise metallic plate members.